



October 3, 2003

Dow Chemical Canada Inc.
Suite 305 South Tower
5811 Cooney Road
Richmond, B.C. V6X 3M1

California Energy Commission
Dockets Office
1516 Ninth Street, MS-4
Sacramento, CA 95814

Attention: Docket No. 03-BSTD-1
Attention: Bryan Alcorn, dalcorn@energy.state.ca.us

Dear Sir/Commissioners:

RE: COMMENTS Title 24 2005 Building Energy Efficiency Standards

Outlined below are our comments for consideration by the Commission with regards to the proposed revisions to the California Building Energy Efficiency Standards California Code of Regulations, Title 24 2005 Building Energy Efficiency Standards:

1. Joint ACM Appendices Appendix IV:

We strongly urge the Commission to reconsider implementation of the Joint ACM Appendices Appendix IV at this time. The proposed U-factor tables do not cover all construction assemblies used today in residential and nonresidential construction and will place proponents of components used in systems not currently included at a major disadvantage caused by the laborious exception method approval process. A common construction type, for example, we believe not currently covered in the proposed U-factor tables is concrete/continuous integral insulation/concrete sandwich constructions (ie: insulated precast, insulated tilt-up and insulated sandwich foundation forming systems). In addition, the tables appear to be much more residential-oriented versus nonresidential. The requirement for the permit applicant or product manufacturer of a construction assembly not included in the proposed U-factor tables to request approval via the exceptional method approval process, we believe, will result in unnecessary, laborious time delays and dollar expenditures. The elimination of the Residential Form 3 and Nonresidential Form ENV-3 should be reconsidered. We also believe the proposed U-factor tables have been made unnecessarily confusing in the Commissions attempt at giving them increased utility - some of the tables appear somewhat confusing and not fully developed; ie Tables IV12 through IV14.

RECOMMENDATION ONE: Postpone implementation of Joint ACM Appendices Appendix IV until such time as the proposed U-factor tables are further developed/expanded through industry consultation and keep current process of Residential Form 3 and Nonresidential Form ENV-3 in place until proposed U-factor tables are further developed. Foam plastic and industry associations such as PIMA (Polyisocyanurate Insulation Manufacturers Association), XPSA (Extruded Polystyrene Foam Association), and RECA (Responsible Energy Codes Alliance) could be consulted by Commission staff and consultant to assist in that development.

RECOMMENDATION TWO: Implement Joint ACM Appendices Appendix IV now, but keep current process of Residential Form 3 and Nonresidential Form ENV-3 for approval of systems not currently in the proposed U-factor tables. Should the Commission ultimately desire to move to the exceptional method approval process, a phase out time period for the current Residential Form 3 and Nonresidential Form ENV-3 can be considered.

2. Joint ACM Appendices Appendix IV:

Please find our specific, detailed comments on individual U-factor tables as listed in the Joint ACM Appendices Appendix IV outlined in Attachment One.

RECOMMENDATION ONE: Consider the individual comments in Attachment One prior to adoption of revisions to the California Building Energy Efficiency Standards.

3. 2005 Building Energy Efficiency Standards – Standards for Residential and Nonresidential Buildings Express Terms – 45 Day Language:

Section 118 (g) Insulation Requirements for Heated Slab Floors, page 64:

RECOMMENDATION: Clarify item 1. B. to ensure it is the insulation core material only that is tested to meet the specified water absorption rate. Facings of thin laminated polyethylene/foil applied to core insulation materials can allow core insulation materials which would normally fail ASTM C272 to pass this water absorption test if tested with protective facers. In fact, such films are often damaged, torn during installation/backfill and do not protect the exposed insulation edges. Also clarify the intent is to conduct the test for 24 hours; Test Method A.

Section 118 (h) Wet Insulation Systems, page 64:

With the current statement that the effective R-value of the insulation shall be as specified in Appendix IV of the Non Residential Manual - there is no Appendix IV in the current Non Residential Manual nor the proposed 2005 Non Residential ACM Manual. If the reference should be the proposed Joint ACM Appendices Appendix IV there also appears nothing there with regards to this issue. If one examines the footnote reference 46 commentary given for this statement, it appears that an original request by Gary Farber to reduce the effective R-value of rigid insulation installed above the waterproofing membrane by a factor of 0.8 was made. That request can be found in the February, 2003 draft of the Joint ACM Appendices Appendix IV but does no longer appears in the July 2003 Express Terms.

RECOMMENDATION ONE: Clarify this administrative error.

RECOMMENDATION TWO: If it is the intent of the Commission to consider this reduction factor of 0.8, the following evidence is offered to refute it and to support its removal from the Standards at this time given California's specific climate zones which are neither overly wet, nor overly cold. The application of a single factor to all PMR roofs throughout the State does not address the benefits of internal cooling in cooling climate zones, nor low rainfall levels/no cold climate in southern California. In such climate zones, PMR roofs would be wrongly penalized by the Code. The XPSA (Extruded Polystyrene Foam Association) can provide Staff with additional research on this topic:

- a). The Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL) has conducted extensive studies of the PMR roof system over the years. In CRREL Report¹ number 76-2 the following conclusions are made about the thermal efficiency of PMR roof assemblies based on their studies:

Internal heat loss is a temporary phenomenon occurring only during the heating season in conjunction with cold rain.

¹ Haldor W. C. Aamot, and David Schaefer, "Protected Membrane Roofs in Cold Regions," CRREL Report Number 76-2, Prepared for Office of Research and Development – Office, Chief of Engineers, Corps of Engineers, U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH, March 1976.

Internal cooling from rain during hot weather reduced the amount of heat gain in the building that would have occurred without rain. This is a beneficial cooling effect that also needs to be taken into account.

b). CRREL uses the concept of Thermal Efficiency in their report. Thermal efficiency is defined as Theoretical heat transfer/actual heat flow, where the theoretical heat transfer is the predicted heat flow through the system based on the calculated U-value of the assembly, and actual heat flow is measured by a heat flow meter.

CRREL studied the thermal efficiency of the PMR assembly at their laboratory in Hanover, NH and found that 80% to 90% of the time the thermal efficiency of the PMR roof was above 100%.

Tests conducted in Germany (and reported in the CRREL report) found internal heat losses of 7.5% occurred with an annual rainfall of 24 in.

Tests conducted by CRREL in NH found internal heat losses of 10.6% with an annual rainfall of 29 in.

c). Tests conducted by The Dow Chemical Company (not covered in the CRREL report), found internal heat losses of 3% in central Ohio with an annual rainfall of 38 in.

d). In their report CRREL does mention that insulation levels should be increased by 10% to 20% in the PMR assembly to account for additional heat loss via internal heat losses. The 20% number is extremely conservative since no test data has been generated to our knowledge that would demonstrate this level of heat loss. The only scenario where this could occur would be a situation where there is a very long heating season and lots of cold rain – definitely not a California climate. This combination isn't very plausible - if there is a very long heating season precipitation would be in the form of snow or ice. In the report CRREL concludes that rain has the greatest effect, and melt water from snow has a similar but much lesser effect.

e). It is suggested that potential thermal shorts through board joints is additional justification for the reduction in thermal resistance. Fact: Thermal bridging through the board joints would be lower for a PMR system than for a single layer conventional system due to the additional ballast overlay in the PMR system.

Table 118-A Insulation Requiring Certification to Standards for Insulating Materials, page 65:

RECOMMENDATION: Add foil-faced bubble pack insulation materials to this table. Unsubstantiated, inflated R-value claims are often made by manufacturers of these materials having no supporting research/test data.

RECOMMENDATION: Under column entitled Form, for polystyrene delete current form and replace with "Board form, molded or extruded. Reason: molded polystyrene insulation is not also extruded.

Section 150 (I) Slab Edge Insulation, page 144

RECOMMENDATION: Clarify item 1. to ensure it is the insulation core material only that is tested to meet the specified water absorption rate. Facings of thin laminated polyethylene/foil applied to core insulation materials can allow core insulation materials which would normally fail ASTM C272 to pass this water absorption test if tested with protective facers. In fact, such films are often damaged, torn during installation/backfill and do not protect the exposed insulation edges. Also clarify the intent is to conduct the test for 24 hours; Test Method A.

4. 2005 Residential ACM Manual, Express Terms, 45-Day Language:

Section 3.5 Infiltration/Ventilation, page 3-12:

RECOMMENDATION: Reduce the requirement for air retarding wraps to have a minimum perm rating of 10 to a minimum perm rating of 5.0. Justification: Air retarding wraps in California with ICBO Evaluation Services reports show:

- equivalency to weather-resistive barriers specified in section 1402.1 of the 1997 UBC;
- are alternatives to the water-resistive barriers specified in Section 1404.2 of the 2000 IBC;
- are alternatives to water-resistant sheathing papers under Section R703.2 of the 2000 IRC.

As a result, they are equivalent to a Grade D building paper having a 60-minute water-resistance rating as described in UBC Standard 14-1 Typical Grade D building paper has a minimum perm rating of 5. The Commission requirement for an air retarding wrap with a higher perm rating than required of building paper, which has been used successfully for years in North America, is unnecessary restrictive. It prevents air retarding wraps which meet ASTM E1677-95, Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls but have perm ratings of between 5-10 from claiming the default reduction in Specific Leakage Area (SLA) of 0.50 without diagnostic testing. There is no basis in building science to keep this value at 10 perms.

Thank you Commissioners for allowing us the opportunity to comment and provide recommendations.

Best regards,



David S. Greeley, P.Eng., Development Leader
Construction Materials Technical Service & Development
(604) 214-0088

ATTACHMENT ONE: Detailed Comments Joint ACM Appendices Appendix IV

1. Joint ACM Appendices Appendix IV, Table IV.3 Standard U-factors of Wood Framed Rafter Roofs:

Very common constructions using rigid, continuous foam insulation are missing:

- a). Continuous rigid insulation (> R10 level) installed above the roof deck is not provided for by this table. Table does not allow for all foam rigid insulation construction.
- b). Foam insulation use between framed rafters is not sufficiently accounted for with cavity insulation levels stopping at R21 in 2x8 joints. Many builders in Northern California use R30 levels of rigid foam insulation (5" ISO insulation such as THERMAX) in this type of construction between the rafters.
- c). 2x4 framing type is listed as 5.5" thick; see row 1?

2. Joint ACM Appendices Appendix IV, Table IV.5 - Standard U-factors of Metal Framed Rafter Roofs:

Again, common constructions using continuous rigid insulation are missing in this table:

- a). As framing depth increases, full continuous insulation without cavity insulation must be an option. We note "None" for cavity insulation and a 2x6 framing depth, but no "None" for cavity insulation at greater framing depths. Such options are needed to represent full continuous insulation only (no cavity insulation) above the deck.
- b). We strongly object to the restriction on continuous insulation given in Footnote 2. It suggests full R30 continuous rigid insulation for example may not be placed entirely above the deck in conventional (insulation below the membrane) and protected membrane roofs (insulation above the membrane) constructions. If the Commission's intent with this footnote was to reduce the effects of thermal shorts through metal framed rafters when using cavity insulation, it unintentionally penalizes continuous insulation instead of rewarding it when used above the deck. A more equitable solution would be to require some minimum level of continuous insulation either above the deck or below the rafters when using metal framed rafter roofs.

RECOMMENDATION: If the intent of Footnote 2 was to reduce the thermal short through metal framed rafters when using cavity insulation only, then require continuous insulation, either above the deck or below the rafters when using cavity insulation.

RECOMMENDATION: Modify the table to allow rigid continuous insulation above the roof deck in either conventional (below membrane) or protected membrane (above the membrane) constructions.

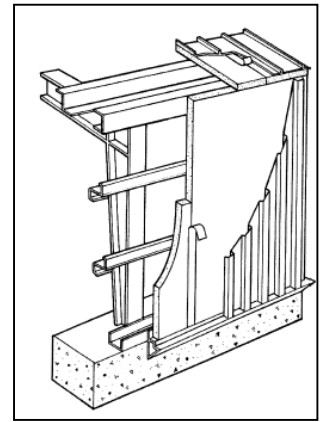
3. Joint ACM Appendices Appendix IV, Table IV.6 - Standard U-factors of Metal Framed Roofs with Attics:

- a) Again, conventional roofs (rigid continuous insulation above the deck, below the membrane) and protected membrane roofs (rigid insulation above the deck and above the membrane) do not appear to have been considered.
- b) Rigid continuous insulation AGAIN has been restricted to below the ceiling framing – why! See note above on Table IV.5. Many flat, nonresidential roofs employ rigid continuous insulation above the roof deck, not below the ceiling framing. Again we suspect the intent was to limit thermal shorts through the metal framing when using cavity insulation.

RECOMMENDATION: Modify the table to allow rigid continuous insulation above the roof deck in either conventional (below membrane) or protected membrane (above the membrane) construction configurations.

4. Joint ACM Appendices Appendix IV, Table IV.7- Standard U-factors of Metal Building Roofs:

- a). Rigid, continuous ISO foam panels are very often used in metal building roofs over the perkins - why not depict that as one of the sketches above the table. In such cases, thermal blocks are not required.
- b). Is the effect of batt cavity insulation compression accounted for in this table?



5. Joint ACM Appendices Appendix IV, Table IV.12 - Properties of Hollow Unit Masonry Walls:

- a). Table has no definition of "Insulated" in column C ? Insulated to what level or with what insulation?

6. Joint ACM Appendices Appendix IV, Table IV.13 - Properties of Solid Unit Masonry and Solid Concrete Walls:

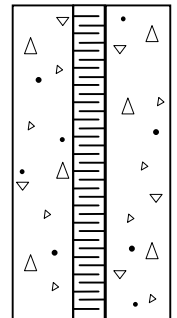
- a). Table has no definition of "Ru" in Property column?

7. Joint ACM Appendices Appendix IV, Table IV.14 Effective R-values for Interior or Exterior Insulation Layers Added to Structural Mass Walls:

- a). Instructions at the beginning of the table are extremely confusing – sending users to multiple areas without clear explanation as to how to combine values. Suggest clarification. This leaves one believing that this table has not been fully developed.
- b). To clarify this table Staff might consider a format similar to:
 - Table 502.2.4.17(1) High-Mass Wall Equivalent R-Values Insulation Placed on the Exterior of the Wall or With Integral Insulation and,
 - Table 502.2.4.17(2) High-Mass Wall Equivalent R-Values Insulation Placed on the Interior of the Wall

which can on page 36 of the 2003 International Energy Conservation Code (copy of tables attached, ATTACHMENT TWO). Such a format is clear, concise and accounts for interior, exterior and integral continuous rigid insulation placement.

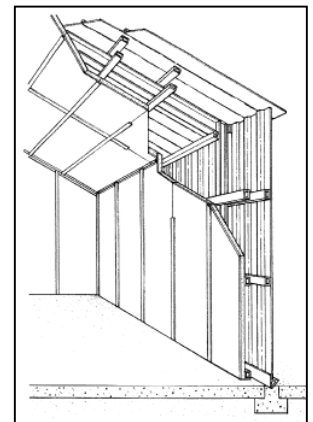
- c). The two equations shown at the beginning of the table appear to be one equation separated by a minus sign. Clarify this for users please.
- d). How does table handle concrete/rigid insulation/concrete sandwich construction such as precast, tiltup and foundation forming construction systems which have integral insulation?
- e). In Row 1, Column K, we believe the tabular value should be 10.5, not 10.



RECOMMENDATION: Modify Table IV.14 to clarify instructions/equations and include reference to concrete/rigid insulation/concrete sandwich constructions where the insulation is integral. Consider format similar to 2003 IECC.

8. Joint ACM Appendices Appendix IV, Table IV.15 Standard U-factors for Metal Building Walls:

RECOMMENDATION: An additional sketch showing rigid continuous insulation installed either on the interior or exterior of the girts – not subjected to compression.



ATTACHMENT TWO: Copy 2003 IECC High-Mass Wall Tables

RESIDENTIAL — COMPONENT PERFORMANCE APPROACH

TABLE 502.2.4.17(1)
HIGH-MASS WALL EQUIVALENT R-VALUES
INSULATION PLACED ON THE EXTERIOR OF THE WALL
OR WITH INTEGRAL INSULATION

WOOD-FRAMED WALL R-VALUE ^a	EQUIVALENT HIGH-MASS WALL R-VALUE					
	HDD 0 - 1,999	HDD 2,000 - 3,999	HDD 4,000 - 5,499	HDD 5,500 - 6,499	HDD 6,500 - 8,499	HDD ≥ 8,500
R-11	R-6	R-6	R-7	R-8	R-9	R-10
R-13	R-6	R-6	R-8	R-9	R-10	R-11
R-14	R-6	R-7	R-8	R-9	R-10	R-11
R-15	R-7	R-7	R-8	R-9	R-10	R-12
R-16	R-7	R-7	R-8	R-9	R-11	R-12
R-17	R-7	R-7	R-9	R-10	R-11	R-13
R-18	R-7	R-7	R-9	R-10	R-11	R-13
R-19	R-8	R-9	R-10	R-11	R-13	R-15
R-20	R-8	R-9	R-10	R-11	R-13	R-16
R-21	R-8	R-9	R-10	R-12	R-14	R-16
R-22	R-8	R-9	R-10	R-12	R-14	R-17
R-23	R-9	R-9	R-11	R-12	R-14	R-17
R-24	R-9	R-9	R-11	R-12	R-14	R-17
R-25	R-9	R-10	R-11	R-13	R-15	R-18
R-26	R-9	R-10	R-11	R-13	R-15	R-18

a. As required by Section 502.2.4 and the tabular entry for "Exterior wall R-value" shown in Tables 502.2.4(1) through 502.2.4(9), as applicable.

TABLE 502.2.4.17(2)
HIGH-MASS WALL EQUIVALENT R-VALUES
INSULATION PLACED ON THE INTERIOR OF THE WALL

WOOD-FRAMED WALL R-VALUE ^a	EQUIVALENT HIGH-MASS WALL R-VALUE					
	HDD 0 - 1,999	HDD 2,000 - 3,999	HDD 4,000 - 5,499	HDD 5,500 - 6,499	HDD 6,500 - 8,499	HDD ≥ 8,500
R-11	R-10	R-10	R-11	R-11	R-12	R-12
R-13	R-11	R-11	R-12	R-12	R-14	R-14
R-14	R-12	R-12	R-12	R-13	R-15	R-15
R-15	R-13	R-13	R-13	R-14	R-15	R-15
R-16	R-13	R-13	R-13	R-15	R-15	R-15
R-17	R-14	R-14	R-14	R-15	R-16	R-16
R-18	R-15	R-15	R-15	R-19	R-16	R-16
R-19	R-16	R-16	R-16	R-20	R-19	R-19
R-20	R-16	R-16	R-16	R-21	R-20	R-20
R-21	R-17	R-17	R-17	R-21	R-21	R-21
R-22	R-17	R-17	R-17	R-22	R-21	R-21
R-23	R-18	R-18	R-18	R-22	R-22	R-22
R-24	R-19	R-19	R-19	R-22	R-22	R-22
R-25	R-20	R-20	R-20	R-22	R-22	R-22
R-26	R-21	R-21	R-21	R-23	R-23	R-23

a. As required by Section 502.2.4 and the tabular entry for "Exterior wall R-value" shown in Tables 502.2.4(1) through 502.2.4(9), as applicable.